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Digital-Biotechnology: A Framework of Bioinformatics used Mobile-Health Technologies in Nigeria-Universities 5G-Readiness Deployment-Plan

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Abstract: Digital Bioinformatics Innovation Initiative (DBII) is a branch of science that used Information and Communication Technologies (ICTs), government electronic services such as electronic government (e-government), electronic health (e-health), and mobile technologies (mobile health) to examine knowledge and information. DBII can also use Internet services or Fourth Generation (4G), and Fifth Generation (5G) services for its deployment and implementation opportunities in developing nations health and healthcare system and other domains. Some of the current digital bioinformatics processes are geometadata profiling, use of mobile technologies (mobile phones) and Artificial Intelligence (AI) in various 5G readiness deployment fields. Despite the benefits of this novel digital innovation, its deployment and implementation have been affected by poverty, lack of enough routine anticipation and determination, initial understanding of mobile phone, inadequate of research funding, personal innovativeness, lack of stable and dependable research methodologies. At present, there is limited number of research that highlighted these aspects to fill in research gaps and find alternative solution to DBII research problems. Therefore, a pilot survey was conducted among professionals in various fields who are knowledgeable about DBII from February 20th, 2020, to January 1st, 2022. Eight academic research professionals, and fifteen health and healthcare workers validated 6 behavior intention factors. Similarly, six hundred postgraduate and undergraduate students, health and healthcare specialists and other professionals across six Nigerian geographical zones participated in pilot survey using the proposed Precaution Adoption Model Process (PAMP) Mobile health questionnaire. Under this situation Principal Component Analysis (PCA) pre-processed online geometadata profiles, experts confirmed behavior intention items towards hypothesis generation, hypothesis testing, and development of digital bioinformatics framework of to use mobile phones in Nigeria Universities 5G readiness deployment plan. The study has discussed several theoretical and practical implications of digital bioinformatics for system designers and developers.

Keywords: Digital-Bioinformatics, Geometadata-Analytics, Mobile-Phone, Nigeria-Universities, 5G-Readiness Deployment Plan

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1. Introduction

Digital Bioinformatics Innovation Initiatives (DBII) is at its infancy, to tackle the analytics of large volume of geometadata profiles increasing at high rate which is important in agriculture, education, science, biomedical and socio-economic research. DBII is a term derived from the use of Information and Communication Technologies (ICTs), government electronic services such as electronic government (e-government), electronic health (e-health) and mobile technologies. Also, DBII can use Internet or Fifth Generation (5G) services for its adoption and adaption among various experts and worldwide populace [1], enabled distribution of vital information and knowledge to improve rural and urban communities' well-being [2] if it is well regulated [6]. One good aspect of DBII is to improve management of biological datasets, support preventive measures and control of transmissible diseases among hard reached communities. However, research funds are inadequate, and geometadata profiles are under constant concerned [7]. Also, lack of ICT infrastructures, lack of enough routine anticipation and determination, initial understanding of mobile health, and motivation, inadequate of research funding, personal innovativeness, responsiveness, and lack of reliable research methodologies.

In addition, there is limited number of research to inform the public especially the executives and policymakers about DBII development initiatives. Therefore, using this novel approach is an opportunity for development of standard DBII geometadata profiles framework to use mobile technologies (mobile phone) in Nigeria Universities 5G readiness deployment fields. In this study behavior intention theoretical factors were reviewed and validated by different professionals including academic research professionals, health and healthcare experts, and other professionals. Also, qualitative, and quantitative research approaches employed [2] [3] [4]. Pilot survey was conducted among different professionals and students. Geometadata profiles, behavior intention factors and items are observed to address research questions and achieved research objectives. Similarly, Principal Component Analysis (PCA) used to pre-process this study findings and put DBII research records straight. Nevertheless, researchers have used several behavior intention theories such as extended unified theory of acceptance and use of technology (UTAUT2) to explain users' acceptance and use of mobile technologies especially mobile phone for diseases screening and treatment support and incorporating Artificial Intelligence (AI) and additional influencing factors (Gansser & Reich, 2021).

Similarly, eight academic research experts and five health and healthcare professionals were contacted about how the study results can represent reality, improve the semantics of our mobile health Precaution Adoption Model Process (PAMP) questionnaire (Hassan Birnin Kudu, Wan Rozaini & Awang, 2021; Yu et al., 2021) to allow behavior intention factors content validity on 5-point Likert scale influenced by the environments in which they are completed. This can serve as reference among academic researchers, and other professionals to check the usefulness and effectiveness of DBII in Nigerian Universities 5G Readiness deployment environment.

2. Digital Bioinformatics Innovation Initiatives

Digital Bioinformatics Innovation Initiatives (DBII) is an area of research, involving the use of Information and Communication Technologies (ICTs), government electronic services and modern mobile technologies, Internet services such as 5G and beyond to make biological data or geometadata analytics significant within scientific disciplines such as development of medicinal remedies and analytical tests, health and healthcare information analysis using statistical models to allow bioinformatics process [4] [5] promoting identification of DNA sequences using machine learning [8], making the analysis of geometadata possible as a key component in developing pharmaceutical products based on intelligence genomic profiling method, an important pathogens quantification sequencing process [18] [5] to support diagnosis and treatment of infectious diseases. Besides, DBII enables the storage of unprocessed biological information moderately in mobile devices like smart mobile phones [9]. This approach can support the concept of digital bioinformatics, improve the understanding of mobile health devices through Internet connected routes [10]. On the other hand, vulnerabilities used to delay DBII implementation and development plans [11] [12] that can safeguard the future [13] research in digital bioinformatics. Moreover, adoption and adaption of geometadata profiling, behavior intention factors and items can be used as basic guide for future research in digital bioinformatics and digital technology innovation research methodologies taxonomy [2] in developing nation like Nigeria.

2.1 Geometadata Profiling in Nigerian Universities 5G Readiness Fields

Geometadata profiling is a controlled representation of specific user's characteristics and individual inclinations with respect to information systems and computing method. As use of mobile technologies such as mobile phones increases, there is a growing need in digital bioinformatics personalization. This necessitates qualitative and quantitative methods of managing geometadata profile content such that it can be retrieved, modernized, and hypothetically shared over Information and Communication Technologies (ICTs) networks. This section explores geometadata profile techniques for managing its content. Similarly, we examine what information constitutes a geometadata profile, how it is represented, acquired, and developed and how the profiles information is used. A reference model is proposed that includes profiles data diagram, a procedure, elementary expertise functions and security mechanisms to provide a foundation for developing mobile phone services and social web services

technologies suitable for implementing digital bioinformatics in Nigerian Universities 5G readiness environment to obtain vital knowledge and information about users in different geographical zones. There are 3 types of geometadata profiling processes including structured geometadata profiling that can be used in confirming behavior intention factors and items, use of basic statistical representations like minimum and maximum values, means, medians, and modes, as well as standard deviation. Content geometadata profiling help in knowing areas that contain open null hypotheses to measure alternative hypotheses.

Similarly, relationship geometadata profiling is to identify various geometadata profiles that can make use of different smart technologies to enable development of digital bioinformatics conceptual model constructs and connection in 5G readiness deployment fields. Additionally, preprocessing of geometadata and behavior intention factors and items is to provide pervasive centered information sharing that can support its implementation approach in delivering short text messaging services (SMS), emails, and applying social media services in an active academic research area commonly used in developing nations. Additionally, other content attributes such as user interests, acquaintance, upbringing, skills, and goals. Behaviors, and individual features including demographic information have an impact on development of digital bioinformatics framework. Similarly, environmental contexts (e.g., noise, web services, temperature, light and humidity). Special context such as blood pressure (BP), and weight. Also, mental context abilities including awareness, stress, depression. Societal context such as friends' information and relationship, time, and drive direction plays a significant role in digital bioinformatics process. Figure 1. showing digital bioinformatics geometadata profiling describing the user location, user role, schedule, online services contacts, event, service access for self-perceived preprocessing of factors and items with adjustment scores (Ferri-Garcia, Rueda & Cabrera-Leon, 2021) in 5G readiness deployment fields.

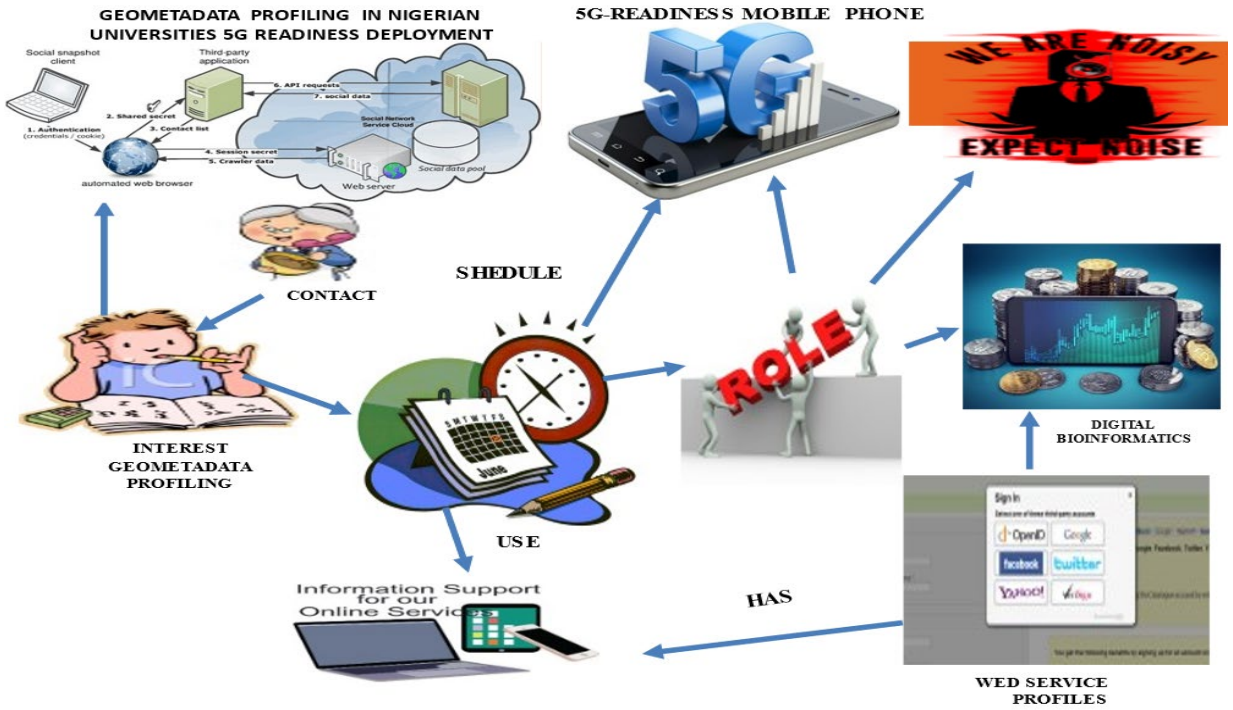

Fig. 1 - Digital Bioinformatics Geometadata Profiling in 5G Readiness Deployment Areas

2.2 Mobile Technology in 5G Readiness Deployment Plan

The concept of digital bioinformatics to use mobile technologies (mobile health) techniques in 5G readiness deployment plan is still relatively new, an easy process, quick and efficient way of obtaining large amounts of unprocessed information from respondents using geometadata profiling, face to face discussion, text messages, audio calls and video calls [4]. Fifth Generation (5G) communication networks can provide wide range of these mobile technology services compared to first, second, third and fourth generation (1G, 2G, 3G, and 4G) communication networks. 5G have moderate latency, network support, and heterogeneous quality of service with unlimited access to information every time and everywhere. This is to make sure all geometadata profiles, behavior intention factors and items measurement scales are identified accurately and progressively recognized towards bioinformatics application in Nigeria [5]. 5G readiness deployment can leads to an increase in speed and consumer use and increase hackers' activity

due to many events happening. However, strong, and efficient security measures must be in place to provide a secured and trusted environment for customers.

Similarly, smartphones are affordable, widespread and their performance can support digitized network (Yu et al., 2021). Thus, digital bioinformatic is a growing field that has attracted a significant attention from academic research experts, students, and other professionals to examine geometadata profiles, and time. Since most of the health and healthcare professionals and other professionals don't have time to control patient geometadata privacy and prevent spread of infectious diseases. Under this situation, mobile health innovation can be used. Although it has being driven by inadequate of well-motivated health and healthcare professionals, lack of funding and insufficient of well-trained physicians. Nevertheless, Principal Component Analysis (PCA) can pre-process both offline and online geometadata profiles, experts confirmed behavior intention factor items towards hypothesis testing. However, knowledge distribution, analysis of biological research themes, and topic values are required [4] to use statistical analytical tools [19] observe geometadata profiles and represent the physical characteristics of respondents and general population [1]. This novel process may be good enough to identify DBII framework problems across six geographical zones, fill in the research gap and achieve research objectives using 7 levels of m-health PAMP questionnaire as follows.

Level One: Lack of initial understanding of m-health Precaution Adoption Model Process (PAMP), perceived mobile health PAMP threats, and inadequate of research funding to support digital bioinformatics geometadata profiling mobile health PAMP literacy programmes. Improve m-health PAMP service qualities. Improve performance expectancy, effort expectancy and attachments of respondents' information characteristics.

Level Two: Academic research experts and other professionals validated and confirmed geometa data profiles, behavior intention theoretical factors and items to enable the researcher obtained loading factor values to improve validation processes, hypotheses generation and hypotheses testing towards development of digital bioinformatics framework.

Level Three: At this level**,** due to hedonic motivation**,** various academic professionals, health and healthcare professionals, undergraduate and postgraduate students, and general populace are qualified or need to join digital bioinformatics geometadata profiling to use mobile health PAMP innovation plans towards self-efficacy, special innovations, and its actual use in 5G readiness deployment areas.

Level Four: Attachment of geometadata profiles to support digital bioinformatics innovation development plans in 5G readiness deployment areas.

Level Five: Academic research professionals and other professionals perceived mobile health PAMP threats amid 5G readiness deployment trials.

Level Six: Professionals are actively participating and managing health and healthcare activities using DBII to use mobile health PAMP process in 5G readiness areas.

Level Seven: Academic researchers, students and other professionals may continue to use digital bioinformatics in finding alternative solution to 5G readiness deployment problems especially in Nigerian Universities. Even though "25 million Nigerians may remain outside telecom coverage after 5G roll out" Therefore, standard DBII framework constructs are to be connected and tested at various levels in understanding of geometadata profiling, expert validation of behavior intention factors and items in Nigerian Universities 5G readiness fields. Figure 2 demonstrates a pathway of DBII for health and healthcare delivery and other socio-economic activities.

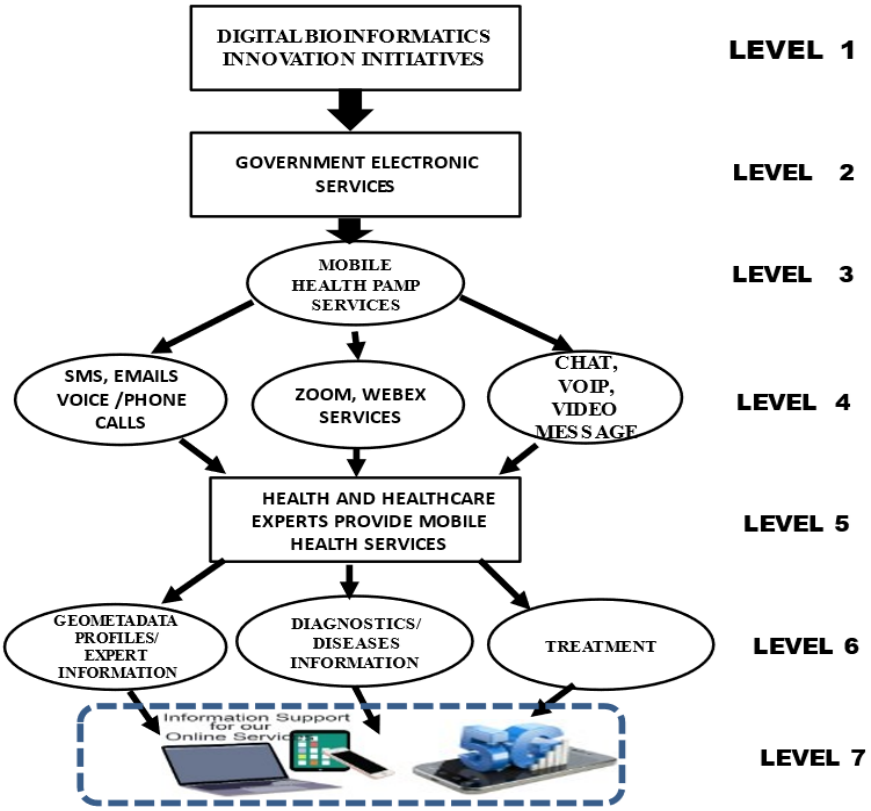

Fig. 2 - Proposed digital bioinformatics pathway in Nigeria Universities 5G Readiness for health and healthcare delivery

2.3 Digital Bioinformatics Framework Development

Development of Digital Bioinformatics Framework (DBF) is to use m-health PAMP services as scientific proofs toward protective action research. Since millions of Nigerians may remain outside of good Internet services after 5G readiness deployment. Digital bioinformatics development process is made up of seven different levels to enable researchers explain this study, improve its design, try theoretical and empirical practices in various domains. To understand the concept of digital bioinformatics, geometadata profiles were examined, behavior intention models were reviewed, including (TRUTAUT) technology readiness unified theory of acceptance and use of technology [20], mobile health adoption, and geometa data profiling [3], and computer mediated communication on learning behavior factors [21]. These studies can be used as a guide for exploring geometadata profiles, behavior intention factors and items as an extension of unified theory of acceptance and use of technology (UTAUT) in 5G readiness Universities.

Nevertheless, eight academic research professionals, and fifteen health and healthcare workers validated 7 behavior intention factors and 9 items Similarly, six hundred postgraduate and undergraduate students, health and healthcare specialists and other professionals across six Nigerian geographical zones participated in pilot survey using the proposed Precaution Adoption Model Process (PAMP) Mobile health questionnaire. Under this situation Principal Component Analysis (PCA) pre-processed online geometadata profiles, experts confirmed behavior intention items towards hypothesis generation, hypothesis testing, and development of digital bioinformatics framework to use mobile phones in Nigeria Universities 5G readiness deployment plan. Adapted digital bioinformatics conceptual model constructs are explored and explained as follows Respondents' demographic features and geometadata profiles including tribe TP-H1, employment-type EMT-H2, and student faculty SF-H3 will significantly affect geometadata attachment GAT-H9 and can play a significant role towards qualitative formative representation. Personal innovativeness PI-H11 will significantly affect performance expectancy PET-H7, and PI-H12 will significantly effort expectancy EET-H8. Mobile health self-efficacy MSE-H13 will significantly affected performance expectancy PET-H7, and MSE-H14 will significantly effort expectancy EET-H8. Likewise, mobile health hedonic motivation MHM-H15 will significantly affected performance expectancy PET-H7, and MHM-H16 will significantly affected effort expectancy EET-H8 Moreover, geometadata attachment GAT-H9 will significantly affect digital bioinformatics in 5G readiness deployment DB5G-H10. Initial understanding of mobile health PAMP IUMHP-H4 will significantly affect DB5G-H10. Initial perceived m-health PAMP threats PMHT-H5 will significantly affect DB5G-H10. Also. mobile

health quality MHPQ-H6 will significantly affect DB5G. Performance expectancy PET-H7 will significantly affect digital bioinformatics in 5G readiness DB5G-H10. In addition, mobile health literacy MHLE-17 and MHLE-18 are moderators can improve the quality of effort expectancy EET-H8 and performance expectancy PET-H7. Similarly, digital bioinformatics amid 5G readiness deployment DB5G-H10 will significantly affect digital bioinformatics actual usage in 5G readiness deployment. Furthermore, gender GM-19 and GF-20 acted as moderators to actual digital bioinformatics usage in 5G readiness deployment plan. Figure 3 the proposed digital bioinformatics framework in Nigeria Universities 5G deployment plan.

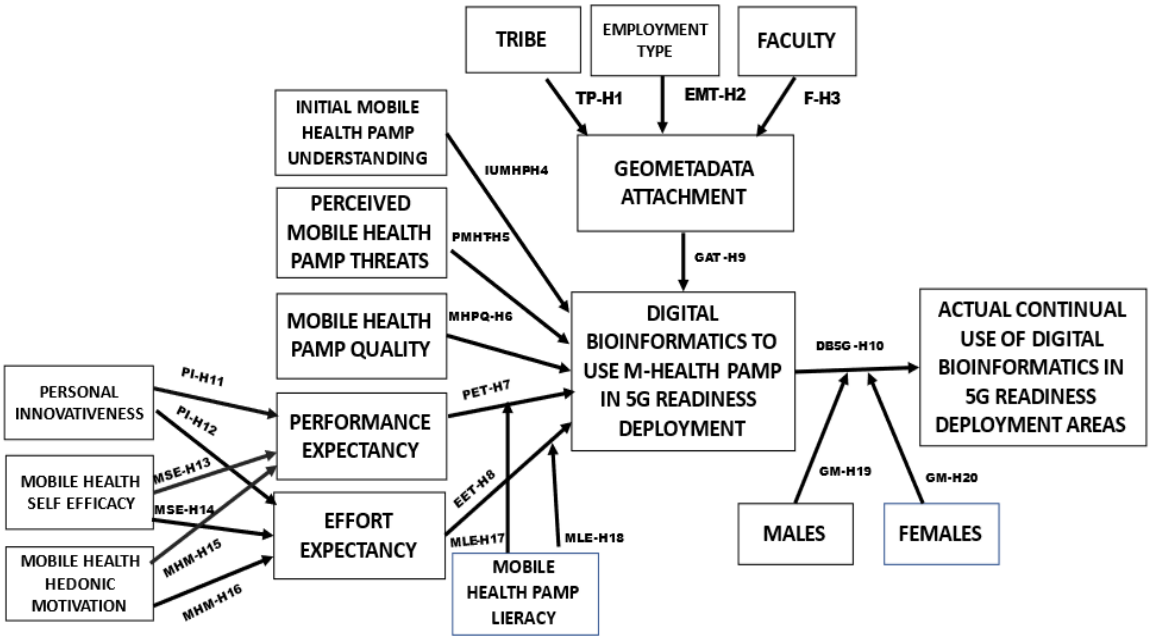

Fig. 3 - Digital bioinformatics framework in Nigeria Universities 5G Readiness deployment

3. Research Method

The effort to measure digital bioinformatics framework constructs began with identifying several research methods and use of statistical models to manage the analysis of geometadata profiles, and behavior intention factors and items. However, to explore and describe the digital bioinformatics to use of mobile health Precaution Adoption Model Process (PAMP) questionnaire for theoretical and empirical practices, this study employed expert validation approach and pilot survey conducted among research experts, students, and other professionals using 5-point Likert-type based on mobile health PAMP questionnaire. 7 Nigerian universities and 5 health and healthcare institutions who are knowledgeable about digital bioinformatics to use mobile health PAMP services from February 20th, 2020, to January 1st, 2022, participated in this pilot survey. This development improved adoption and adaption of online geometadata profiles, behavior intention factors and factor items. Qualitative and quantitative methods and Principal Component Analysis (PCA) were employed to pre-processed geometadata profiles and experts confirmed behavior intention factors and items.

4.0 Discussion

Digital bioinformatics mobile health PAMP services in 5G readiness Nigerian Universities used standard biological analytical tools in managing academic research irrespective of whether the study is in physical, social sciences, or any other disciplines. The integration of geometadata profiles, behavior intention factors and factor items into digital bioinformatics framework can provide research focus towards positive 5G readiness deployment plans by identifying many other factors in different domains, proving the real situation based on the present and past experiences of using mobile health technologies. Therefore, respondents' geometadata profiles, behavior intention factors and items are adopted and adapted as independent variables and dependent variables towards development of digital bioinformatics conceptual model constructs, hypotheses testing, and analysis. Besides, minimum sample size of 50 and above are considered when considering a model containing five or more expert' confirmed conceptual model factor

constructs. Besides, principal components analysis applied to reduce high dimensional sample sizes that are more the conceptual model constructs to avoid information overload and evaluate mobile health PAMP parameters that is usually done at the design stage to set the record straight [24]. Since Africa mostly, Nigeria for instance have not absorbed the advantage of using digital bioinformatics in maintenance of geometadata profiles in addressing human factors, ergonomics in health and healthcare, and medical strategies [25].

5.0 Conclusion

The COVID-19 Omicron virus has affected all aspects of community's socio-economic lives and economic growth. There are a lot of opportunities and benefits that digital bioinformatics can offer through the support of mobile health PAMP process. However, these services need to be improved with the right digital technological innovations. Knowing very well how digital analytical tools are very important and can play a significant among communities and perceive benefit values to use digital bioinformatics mobile health PAMP process in 5G readiness deployment areas. Nevertheless, during expert validation process pre-processed geometadata profiles, and behavior intention factors are with loading values of 0.50 to 0.97. Similarly, Principal Component Analysis (PCA) pre-processed geometadata profiles, experts confirmed behavior intention factors and items with loading values of 0.08 to 0.98 towards hypothesis generation, hypothesis testing, and development of digital bioinformatics framework to use mobile health PAMP process in Nigeria Universities 5G readiness areas. The study has several theoretical and practical implications for digital bioinformatics designers and developers towards national policy design and implementation. Poor outcomes, inadequate of funding and lack of digital bioinformatics innovation awareness in 5G readiness deployment period and beyond will result in lack of understanding mobile health PAMP process among academic researchers, undergraduate and post graduate students, and other professionals in urban and rural setting of developing nations like Nigeria. Behavior intentions factors may be significant features to use mobile health PAMP process in [2] [3] [4] [5], theoretical, and empirical practices [26] [27] [28] [29] [30] [31] [32] in identifying strengths, weaknesses, opportunities, and threats of pathogens infection [33].

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References

[1] Ferri-Garcia, R., Rueda, M-M., & Cabrera-Leon, A. (2021). Self-Perceived Health, Life Satisfaction and Related Factors among Healthcare Professionals and the General Population: Analysis of an Online Survey, with Propensity Score Adjustment. Mathematics 9:7, pages 791

[2] Hassan Birnin Kudu, A., Wan Rozaini, S. O., & Awang, H. (2021). Digital-Technology Innovation Research Methodologies Taxonomy Beyond-PCR Strategies Among Primary-Healthcare Workers Nigerian Local-Government. 3rd International Scholars Conference Universiti Utara Malaysia (3rd ISCUUM 2021) March 29-31, 2021

[3] Hassan Birnin Kudu, A., Wan Rozaini, S. O., & Awang, H. (2021). Digital-Health Tourism Research-Methodology Coronavirus-Vaccination Trials: A Study Interpreting Geometa-Data Profiling to use Mobile-Health Technologies Nigeria. *Emerging Advances in Integrated Technology* (EmAIT) Vol (2) 2 (2021) 30-37 e-ISSN: 2773-5540. Available at http://publisher.uthm.edu.my/ojs/index.php/emait

[4] Hassan Birnin Kudu, A., Wan Rozaini, S. O., & Awang, H. (2021). Digital-Biotechnology COVID-19: Proposed Biosecurity-Bioinformatics Framework to use Mobile-Health Sensors in Nigerian Open-Grazing Ranching. *Faculty of Education, Federal University Dutse Maiden International Conference 12th – 15th October 2021*

[5] Hassan Birnin Kudu, A., Garko, A. B., Lawan, A., & Ado, Y. S. (2015). Bioinformatics: Literacy Survey among Medical Professionals and Researchers in Jigawa State, Nigeria. *Dutse Journal of Pure and Applied Sciences* 1(2) December 2015 pp 199-206. ISSN 2476-8316

[6] Fayehun, F., Omigbodun, A. & Oweaje, E. T. (2020). Mobile technology can improve access to healthcare in Nigeria – if it's regulated. The Conversation, May 6, 2020. Available at https://theconversation.com/mobile-technology-can-improve-access-to-healthcare-in-nigeria-if-its-regulated-137182

[7] Pramod S, Govindan D, Rama Subramani P, Kar SS & Aggarwal, R. (2021) *Group J vaccine effectiveness study. Effectiveness of Covishield vaccine in preventing Covid-19 – A test-negative case control study* 2021 Jul [cited January 5th, 2022]. Available at https://www.medrxiv.org/content/10.1101/2021.07.19.21260693v1

[8] Khan, Z., Rajdeep, R. K. Arya and T. Kanumuri, (2020) "Promoter Identification in DNA Sequences Using Machine Learning," 2020 *IEEE 17th India Council International Conference (INDICON*), 2020, pp. 1-4, doi: 10.1109/INDICON49873.2020.9342360.

[9] Odunsi, W (2022). IHU: New vaccine-resistant COVID-19 variant found in France, linked to Cameroon. *Dailypost* January 5, 2022. Available at https://dailypost.ng/2022/01/05/ihu-new-vaccine-resistant-covid-19-variant-found-in-france-linked-to-cameroon/

[10] Piel, J., Robinson, S. L., & Sunagawa, S. (2021). A roadmap for metagenomic enzyme discovery. *Nat. Prod. Rep.*, 2021, 38, 1994-2023 DOI: 10.1039/D1NP00006C Available at https://pubs.rsc.org/en/content/articlepdf/2021/np/d1np00006c

[11] Yang, Y., You Che, Lei Liu, Chunxiao Wang, Xiaole Yin, Yu Deng, Chao Yang, Tong Zhang. (2022) Rapid absolute quantification of pathogens and ARGs by nanopore sequencing. Science of The Total Environment 2022, 809, 152190. https://doi.org/10.1016/j.scitotenv.2021.152190

[12] Hair, J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. Journal Business Research 109 (1): 101-110.: doi.org/10.1016/j.jburres.2019.11.069

[13] Darmawan Napitupulu et al. (2020). Proposed TRUTAUT model of technology adoption for LAPOR! *IOP Conf. Series: Materials Science and Engineering* 725 (2020) 012120 doi:10.1088/1757-899X/725/1/012120

[14] Braga M, Araujo F, Franco E, Pinheiro K, Silva J, Maués D, Neto S, Pompeu L, Guimaraes L, Carneiro A, Hamoy I and Ramos R (2021). Bioinformatics on the Road: Taking Training to Students and Researchers Beyond State Capitals. Front. Educ. 6:726930. doi: 10.3389/feduc.2021.726930

[15] Fujimoto, A., Wong, J. H., Yoshii, Y., Akiyama, S., Tanaka, A., Yagi, H., et al. (2021). Whole-genome Sequencing with Long Reads Reveals Complex Structure and Origin of Structural Variation in Human Genetic Variations and Somatic Mutations in Cancer. Genome Med. 13, 65. doi:10.1186/s13073- 021-00883-1